resistance of the ground electrode **30** can be enhanced. One end of the core material **38** preferably extends to a portion near the noble metal tip **31**, and the other end of the core material **38** preferably extends to the metal shell **50**. The coefficient of thermal conductivity of the core material **38** is preferably higher than the coefficients of thermal conductivity of both the ground electrode **30** and the noble metal tip **31**. Further, the coefficient of thermal conductivity is preferably increased in the order of the noble metal tip **31**, the ground electrode **30**, and the core material **38**. The core material **38** may be formed of, for example, a copper alloy or pure nickel. The ground electrode **30** having the core material **38** can be produced by, for example, a clad material that has a material forming the core material **38** at the center of the material forming the ground electrode **30**, being subjected to plastic processing such as drawing process.

**[0036]** FIG. **5** illustrates a schematic configuration of an ignition system **200** that includes the spark plug **100**. The ignition system **200** is a system for igniting air-fuel mixture supplied to the internal combustion engine. The ignition system **200** includes the spark plug **100**, a first power supply **210**, and a second power supply **220**. The ignition system **200** further includes a control unit **230**, an impedance matching circuit **240**, and a mixing circuit **250**.

**[0037]** The first power supply **210** is a power supply that applies, as first power, a high voltage for causing spark discharge in the spark plug **100**, between the center electrode **20** and the ground electrode **30**.

**[0038]** The second power supply **220** is a power supply that applies, as second power, a voltage having a relatively high frequency (for example, higher than or equal to 1 MHz and not higher than 20 MHz), to the spark plug **100**. The second power is applied between the center electrode **20** and the ground electrode **30** by the second power supply **220** while spark discharge is generated.

**[0039]** The mixing circuit **250** connects the first power supply **210** and the second power supply **220** to the spark plug **100**. The mixing circuit **250** includes a coil **251** and a capacitor **252**. The coil **251** is connected between the first power supply **210** and the spark plug **100**. The capacitor **252** is connected between the second power supply **220** and the spark plug **100**. The coil **251** inhibits power from the second power supply **220** from being inputted into the first power supply **210**. The capacitor **252** inhibits power from the first power supply **210** from being inputted into the second power supply **220**. When the first power supply **210** includes a coil, the coil **251** may not be provided.

**[0040]** The impedance matching circuit **240** is connected between the second power supply **220** and the mixing circuit **250**. The impedance matching circuit **240** matches an output impedance of the second power supply **220** with an input impedance on the mixing circuit **250** and the spark plug **100** sides (that is, load side) during spark discharge in the gap G. Thus, attenuation of the second power supplied to the spark plug **100** can be inhibited.

**[0041]** The control unit **230** is a device for controlling a time when power is supplied to the spark plug **100** from each of the first power supply **210** and the second power supply **220**. The control unit **230** is formed by, for example, an ECU (Electronic Control Unit) that includes a CPU (Central Processing Unit) and a memory.

**[0042]** The ignition system **200** having such a structure allows high electric energy to be supplied to the spark plug **100**. For example, electric energy of 400 to 500 mJ which is a sum of the first power and the second power can be supplied to the spark plug **100**. Therefore, even when the spark plug **100** is mounted to an internal combustion engine in a highly compressed and highly supercharged state, ignitability for air-fuel mixture can be improved.

## B. Result of Evaluation Test

### B1. Ratio S1/S2 in Area:

**[0043]** Table 1 indicates test results of an ignitability test and a wear resistance test for various samples (sample Nos. 1 to 30) of the spark plug **100**. The test result represents a relative evaluation in comparison with a spark plug (sample No. 0) that was prepared as comparative example. The ground electrodes **30** of the samples including the sample of comparative example were formed of the same material (Inconel (registered trademark) **601**). Further, the noble metal tips **31** of the samples including the sample of comparative example were formed of the same material (platinum alloy). In each of the samples indicated in Table 1, the coefficient of thermal conductivity of the ground electrode **30** is lower than the coefficient of thermal conductivity of the noble metal tip **31**. In each of the samples including the sample of comparative example, the gap G was 1.1 mm in size. In each of the samples including the sample of comparative example, the ground electrode **30** did not include the core material **38**.

TABLE 1

| No. | Center electrode (mm) | Tip size (mm) | Ground electrode (mm) | L1 (mm) | L2 (mm) | T (mm) | S1 ($mm^2$) | S2 ($mm^2$) | S1/S2 | Ignitability | Wear resistance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Φ1.2 | 1.5 × 0.7 | 2.7 | 0.65 | 0.00 | 0.30 | 0.79 | 0.60 | 1.32 | — | — |
| 1 | Φ0.8 | 0.9 × 0.9 | 2.7 | 0.10 | 0.20 | 0.40 | 0.40 | 0.72 | 0.56 | A | A |
| 2 | Φ0.8 | 0.9 × 0.9 | 2.7 | 0.20 | 0.10 | 0.40 | 0.47 | 0.63 | 0.74 | A | B |
| 3 | Φ0.8 | 1.4 × 1.4 | 2.7 | 0.10 | 0.20 | 0.40 | 0.40 | 1.82 | 0.22 | A | A |
| 4 | Φ0.8 | 1.4 × 1.4 | 2.7 | 0.20 | 0.10 | 0.40 | 0.47 | 1.68 | 0.28 | A | A |
| 5 | Φ0.8 | 1.8 × 1.8 | 2.7 | 0.10 | 0.20 | 0.40 | 0.40 | 3.06 | 0.13 | B | A |
| 6 | Φ0.8 | 1.8 × 1.8 | 2.7 | 0.20 | 0.10 | 0.40 | 0.47 | 2.88 | 0.16 | B | A |
| 7 | Φ1.1 | 1.4 × 1.4 | 2.7 | 0.10 | 0.20 | 0.40 | 0.83 | 1.82 | 0.46 | A | A |
| 8 | Φ1.1 | 1.4 × 1.4 | 2.7 | 0.10 | 0.40 | 0.40 | 0.64 | 1.82 | 0.35 | A | A |
| 9 | Φ1.1 | 1.4 × 1.4 | 2.7 | 0.30 | 0.10 | 0.40 | 0.91 | 1.54 | 0.59 | A | A |
| 10 | Φ1.1 | 1.9 × 1.9 | 2.7 | 0.10 | 0.20 | 0.40 | 0.83 | 3.42 | 0.24 | A | A |
| 11 | Φ1.1 | 1.9 × 1.9 | 2.7 | 0.30 | 0.20 | 0.40 | 0.83 | 3.04 | 0.27 | A | A |
| 12 | Φ1.1 | 2.2 × 2.2 | 2.7 | 0.10 | 0.20 | 0.40 | 0.83 | 4.62 | 0.18 | B | A |